structure.

This is the general arrangement of the principal story, illustrated by the plan of the passages, Fig. 188. Subdivision in detail proceeds without further difficulty, like the lower story. Of especial interest is the ground story with noble entrance hall, the commencement of the staircase, and the carriage passage from Schwartzenburg Place to Pestalozzi St. The principal facade is shown in Fig. 187 and corresponds to the requirements of the problem. A comparison of the ground area covered with the utilized area is limited to the principal story and an addition of 80 per cent to the latter is required. The limits for these explanations would be exceeded, if the method for designing were discussed further. The way is opened to be pursued in the next Division.

DIVISION IV.

TREATMENT OF EXTERNAL AND INTERNAL ARCHITECTURE.

By Professor Joesph Buhlmann.

Chapter 1. Forms of Facades.

133. General.

The appearance of a building depends on two factors. The first is the form of its entire mass, which primarily impresses itself upon an observer, and at a distance this is alone perceptible. Secondly come the vertical surfaces of these masses, usually only visible near at hand, but which by their subdivision and ornamentation produce the particular impression or individual artistic effect. It will be best to briefly summarize that said in the preceding Division on the first point.

The mass of a building may be united or closed, may be divided in detached masses or be grouped. A closed form produces a simple prismoidal, cylindrical, or pyramidal mass, if the programme proposes a very simple purpose, fulfilled by a single room, or if similarity of required rooms permits them to be combined in a single united form, indicated by reasons of construction and suitability. A grouping of the entire building occurs if the building programme requires a number of rooms, serving for unlike purposes, and which can properly be arranged only in separate buildings. The organic connection of the different rooms requires a combination of the masses into a single architectural whole. By prominence of the chief portion and subordinate annexing of less important rooms in a symmetrical position along a main axis, diversity of such an architectural group produces a united and organic appearance. Since the arrangement of rooms

affects the external form of the entire building, it is clear that in designing the ground plan, the external appearance must be considered, so that plan and elevation can in their essemtial forms only be designed together.

If in Chapter 1 of this Division forms of facades be treated without examination of the different purposes of the building, only in regard to external form, this can only occur for single and detached forms of buildings, or for separate architectural masses forming portions of grouped structures. The grouping may here be considered only from ordinary points of view, and must in the expression of the different structural forms be treated in accordance with the diverse purposes.

134. Construction of External Walls.

External surfaces or facades of every structure are first dependent upon the construction of the external walls. This requires a vertical position of the walls, their diminished thickness upwards with resulting batter or offsets; it further requires placing the openings above each other and a firm and pier-like treatment of structural masses between them. Even protection of the external surfaces by a projecting roof or cornice may under some circumstances be considered as a structural requirement. That the external walls of a structure may produce a durable and monumental impression, they must have a combination assuring the greatest possible strength, and materials must be employed possessing great resistance to all external influences.

As the simplest construction a superposition in courses or a stratification of the material, and natural or artificial stone has proved to be the most suitable and durable material. All walls constructed of a framework of wooden posts and beams produce no monumental impression, on account of the slight durability of the materials, and by the relatively small strength of the construction itself. Yet upper terminations of facades may have a projecting frammed construction in simple corbelled form, and this may be so treated as to harmonize with the stone wall in regard to durability.

135. Vertical subdivision of Building.

The artistic treatment of facades naturally follows the construction; it first strives to produce an effect of stable resistance, which essentially determines the monumental appearance of the architecture, and then subdivides the vertical elevation in a manner appropriate to firm construction. According to this view of the treatment of the facade, there result as essential parts of every facade:-

1. A firm foundation or a thickening of the wall interposed between

it and the ground. This footing becomes externally a platform or a base course, on which the building appears to be built. It may consist of a strongly projecting base or of a high and slightly projecting offset. It always demands simple form without ornament and the expression of great resistance, best produced by using conspicuous and massive cut ashlars with wide beds.

2. The actual enclosure of space by vertically aspiring walls, whose structure is externally shown by the horizontal courses. In ashlar masonry, a reduction of height of the rate courses upwards corresponds to diminished thickness of the wall, and more readily permits this to appear with the increased height.

3. The projecting edge of the roof above the wall is supported by the uppermost and projecting cour ces of the wall, these together composing the crowning entablature. In most monumental forms, the edge of the roof is exclusively supported by stone courses, which are of different forms but compose a homogeneous stone entablature. In contrast with the development of the base or footing, these upper and prominent courses should have a character of the greatest lightness; they should represent the free ending, the uppermost termination. These peculiarities belong in a high degree to entablatures of wood, and it is therefore natural that forms originally worked out in wood should have become, and continued to be typical for stone entablatures also.

136. Horizontal Subdivision of Building.

While the construction of the building necessitates subdivision in a vertical direction, the purpose of the structure causes a division horizontally. This horizontal division usually extends from the center as an axis of similar masses or of symmetry, arranging the masses on both sides of this similarly, and placing terminations at each end. As for special treatment of the centre in accordance with purpose of the building, this may be developed from a simple portal to a richly treated central architectural mass. The side terminations first appear in using at the angles a stronger material, larger ashlars, or projecting pilasters or piers for strengthening the wall. In extended designs of facades, these endings consist of special architectural masses, to which is assigned an importance subordinate to that of the central mass. The vertical and horizontal subdivisions must permit the facade to appear as a unity, to which nothing can be added or removed without thereby injuring its perfection.

Every building must stand in contrast to its surroundings as an organic whole, only appearing to be connected to the ground by the universal law of gravity. Around the chief apartment for material or ideal uses,

through which passes the principal vertical axis of the central portion of the elevation, subordinate rooms are grouped along horizontal axes extending from the center. The enclosed space rises from a firm base and extends upward in accordance with the laws of growth and in opposition to the force of gravity. The external surface or facade of the building causes these internal factors of the whole to appear externally; it expresses both structural requirements and the intellectual importance of the building.

a. Vertical Subdivision of Facade.

137. Expression of Construction.

If in the design of the facade structural elements alone appear, a simpler and severer character will thereby be produced. The particular expression is that of the mode of construction, which is dependent on building material and kind of masonry. By a construction severly executed in even the external appearance, only a very moderate variety of form can be produced, and such a treatment of the facade cannot rise above the rude character of mere utility. Yet structural forms may assume decorative shapes and may be combined with forms not structurally necessary, but which only serve for expressing a function, without dropping the rude character corresponding to the construction. Decorative accessories, used independently of the structural combinations, may lend grace and elegance to a building otherwise cold and severe.

138. Rusticated Facades.

Rusticated facades are the simplest and the most monumental form of structural facades, and are produced when in ashlar masonry the separate blocks are decorated by drafted margins and raised bosses (Fig. 189). A wall composed of dressed ashlars possesses equally in all parts great stability; to especially emphasize angles of projections or courses at the levels of the ceilings does not appear to be required. As for heavy masonry, the base of this form of facade must be massive and strongly projecting. A projecting course of large ashlars may be covered by a slab above a step, thus being transformed to a seat. The bosses of the vertical wall may rest directly on this bench; yet the architecture of the Early Renaissance frequently placed there an intermediate cyma of form suitable for a base, and employed these together to compose a bordering band with a strong effect of shadow. In accordance with the structural character of the architecture, door and window openings were spanned by arches with bosses, or by lintels, if moderate in width.

Within the larger window openings is a recessed wall with graceful treatment in contrast to the stiff ashlar masonry and having an excellent effect (Fig. 190). Like a continuous band or belt with slight projection

and a gently curved cyma and dentil band, the window sill is effectively contrasted with courses of bosses and forms an easy division of the surfaces, without actually interrupting their vertical tendency. The window sill as a belt-course is nothing more than a slightly projecting and ornamented course of stone, and its height should therefore coincide with that of the other ashlar courses. The entrance door or gateway likewise requires jambs inside the bosses, and these may be developed from a plain reveal to a strongly profiled architrave (Fig. 191). A considerable depth of jamb is always required to produce the necessary appearance of stability. No rectangular window in the ground story or in any mezzanine story may dispense with an architrave next the bosses. It appears unsuitable to place large rectangular doors or windows in a rusticated wall and give them architraves, whose forms were derived from wooden construction, requiring straight lintels to support the masonry above them. The stability of the wall then appears to the eye as if injured by an insufficiently strong covering of the openings.

The entablature may always borrow its forms from entablatures of antique columnar orders, which chiefly originated in wooden construction; the Corinthian type with its rich subdivisions especially forms an effective contrast to the simple rusticated wall. Yet entablatures which appeared later in stone construction deserve full consideration in spite of their massiveness. The mediaeval cornice of Italian- palace-castles composed of tall inclined corbels supporting stone slabs was the motive for a corresponding form of Renaissance entablature. A stone course decorated by a cyma moulding forms the base for corbels or consoles. These are inclined supports beneath the cornice that recieve an ornamental form, which expresses their purpose. Above the slab and connected with it by its cyma moulding, the cornice rises as a free ending. Square spaces between consoles are suitable localities for rich decorative ornament in strong relief. (Fig. 192). If antique entablatures, those most suitable having forms much subdivided and rectangular or ogee consoles, be employed to crown ashlar walls, they must be treated with imposing height and severity to harmonize with the character of the lower architecture. By architects in the Florentine Renaissance the principle appears to have been established, that the entablature above a palace must be made large enough to be suitable for a colonnade of equal height. For the Corinthian type of entablature, this is from one twelfth to one-fourteenth the entire height. A plain frieze is divided from the wall surface by a boldly profiled course which preferably separated the refined forms of the cornice from the rusticated work.

The rusticated wall may in its height be changed from heavy to light effect by reducing height of ashlars and projections of bosses in the different stories. (Fig. 193) External surfaces of stones may vary from a boss of semicircular section to a flat boss with rounded edges. In old facades of this kind, the ground story is usually enclosed and has small windows. Yet there remain from the Renaissance period fine examples of such facades with great lower arched openings, likewise suitable for modern purposes. The completely rusticated facade emphasizes unity of vertical enclosure of space and combines different stories into a single form. The diverse character of the different stories may then be expressed only by dimensions and shape of window openings, while the proper subdivisions and especially the frame-work of the floor, do not appear externally. By their grand and simple form and their monumental stability, such facades make an imposing impression; yet they likewise possess a monotonous and gloomy character.

139. Richer Facades.

A facade of richer form is produced, if the elements of the vertical structure are apparent externally according to their importance. This may be done by making prominent the separate stories by limiting belt courses and by ornamental enclosures of their window openings. For this purpose forms are usually employed that did not originate in stone, but by their use in structures first built in wood and later in stone, they have acquired an expression suited to the latter material. To the esthetic character of these forms, retained even in the translation into stone, structural jointing of the wall must not be too strongly opposed or be but slightly contrasted, otherwise insoluble contradictions will arise. But in portions of the facade requiring special stability, an external prominence of structural forms is indicated. The ground story and the angles of projections may be treated as rusticated work, thereby forming an effective contrast with the smooth wall surfaces of the upper portion, which merely appears as a background for ornamental architraves of windows. (Fig. 194). In such forms of facades, with simple general form having clear subdivision, a great wealth of details and ornamental accessories may be developed. Yet the general character of the facade retains a certain strength and severity, while the general mass of the building appears as a quiet wall surface, where aspiration and opposition to force of gravity are not yet expressed by special forms. Special treatment of such facades will be in accordance with the number of stories, and it is then necessary to consider them in this respect.

140. Buildings of Two Stories.

In a building of two stories, the principal story may either be placed above a high ground story (Fig. 195), or may be placed directly above a low structure, then supporting an upper story. In both cases, a belt course is arranged externally at the level of the floor of the principal story, appearing as a high and slightly projecting course or band. The pedestal band required between this belt and the window openings has its own base and cap. The former is of simple and slightly projecting form, being scarcely visible above the belt from beneath, but the latter is formed with plinth and cyma mouldings. To make it prominent, the principal story demands an especially characteristic enclosure of the windows. Therefore that rich form may be employed, which is composed of a small shrine (Aedicula), having columns or pilasters and an architrave inside them. Pedestals for columns or pilasters will project from the pedestal band; between these and before the windows may be placed slightly projecting balconies with balusters. The strength of the belt course permits the projection of a balcony to its outer edge. The entablature of the pediment cap appears firmly joined to the wall, if the architrave and cornice extend along the wall as flat bands representing special courses of stone. The spaces enclosed between the enclosures of the windows and these bands are suitable for painted or sgraffito ornamentation, or for niches and figures.

As a massive band, the belt course is not broken around the angles; but the pedestal band must form a pedestal beneath the angle quoins and it then projects from the pedestal as much as the bosses (Fig. 196). If the principal story is placed above a ground story, the latter has a massive character by ashlar masonry, or at least by simple and plain forms of windows. Arched windows may be conveniently employed in the ground story, but those with straight lintels are to be used in the upper story. Between the windows of the principal story and the main entablature should be a wall space at least equal to the clear height of the window; but subordinate windows of mezzanine stories may be placed directly beneath the entablature and be connected with a broad frieze decoration. Only bosses of angle quoins project beyond the wall surfaces, the drafted margins being flush. Belt courses and frieze bands are then extended through these bosses straight to the angle without breaks. The Corinthian form of entablature is in height arc-fifteenth to arc-eighteenth part of the height of the facade. Its frieze beneath it has a good effect as a termination of the wall and transition to the cornice, while it forms together with the cornice a rich crown to the building.

141. Buildings of Several Stories.

In designs containigg several stories, the principal story is usually placed over the ground story; the latter being treated as the substructure for the facade (Fig. 197). A subordinate mezzanine story may be interposed between these two stories and combined with the ground story on the exterior. If only a single story be placed above the principal story, then to obtain free wall space above the windows of the former, a belt course is only placed below the windows of the upper story. In contrast to the lower belt course indicating the floor, this is composed of a thin slab and cyma mouldings; a narrow frieze band beneath them gives it the height required for effective division of the surface.

If more than two upper stories are arranged above the ground story, it is then best to divide the facade into three principal surfaces, the lower one being characterized as the base, the middle one or highest one being the superstructure, and the uppermost one of less height being the crowning and dominant portion. The substructure may comprise both ground and mezzanine stories. Above the principal story, characterized by its external forms, the windows of the next story are placed directly above the entablature of the lower ones. Yet the lower windows must then have a strong projection and the upper ones have flat architraves; if treated too nearly alike, these easily recieve a stilted appearance. The highest story will be joined with the main entablature like a deep frieze. Its window caps (if used) are connected by a band like an architrave, and must be separated from the main entablature by a frieze band. Surfaces between windows have light ornamental decoration by painting or sgraffito-work.

The portal usually indicates the axis of symmetry in the centre of the facade, and it may recieve a rusticated arch or be enclosed by forms of the columnar orders. Its cornice should then be at the same height as the belt course, when the forms of the cornice and belt may differ in accordance with their varying importance. If a mezzanine story be connected with the ground story, the portal architecture may extend through the entire height of the substructure.

142. Facades in Ordinary Brick Masonry.

Facades in brick masonry with moulded bricks for belts, cornices, and architraves, may be treated with reference to peculiarities of the material in a pleasing and monumental way. Openings are to be arched, but there may be set within them a rectangular architrave of stone, with filling between arch and architrave. The material requires slight projections of belts and decorations so that the numerous abutting joints may not become appar-

ent, and beaded astragals, dentils, grooves on bands, etc. Continuous friezes and panels of pilasters must be so arranged on the drawings, that with repeats of the same forms they may appear connected and flowing. Architraves of doors and windows may be composed of decorated cyma mouldings and frieze-like bands, producing their effect less by bold relief than by rich ornament and clean profiles. The entablature is composed of several courses with projecting consoles, and in brick alone may produce an effective crown to the facade, but this should be combined with a wooden cornice attached to the rafters and projecting above it. If large openings or porticoes are in the ground story, piers or columns must necessarily be of cut stone. Excellent models are supplied by brick facades of Renaissance period in Bologna.

Certain portions of brick facades may be decorated by relief ornaments in terra cotta, especially the frieze above ground story or beneath the main cornice, and panels between the windows. A rich frieze is particularly suitable above an open portico in the ground story. This should be bordered above by a delicately profiled belt course, and beneath by a band like an architrave. The spandrels of arches are decorated by round disks or medallions. Magnificent ornaments of this kind in the Early Renaissance were composed of sculptured terra cotta reliefs enamelled in colors (Luca della Robbia). The simple and conventional coloring required by technical processes and the fresh and permanent lustre of the colors in contrast with the dead tones of the bricks lend a peculiar charm to this mode of decoration, so that for this purpose it is to be preferred to any other mode of ornamentation. An excellent effect is likewise produced by these glazed terra cottas on white stuccoed wall surfaces, when inclosed between sand stone belts.

143. Sgraffito Facades.

For decoration of surfaces of facades coated with stucco, sgraffito is especially suited by its similarity and durability (Fig. 198). This decoration may appear as a surface pattern either dark on light, light on dark, or as a hatched drawing. It harmonizes best with architectural forms when very little effect in relief is attempted, this being always slight in the process of sgraffito. Motives for these decorations are antique Grecian vase paintings, where within the outlines of figures only simple lines are used to separate different parts, the entire figures being then made prominent in light on dark or conversely.

Decoration of an entire facade by tapestry-like patterns is justifiable only in special cases. When two lower stories are composed of light arcades, like the Doge's palace in Venice, a high enclosed upper story above them can only be made endurable by giving the enclosing walls the greatest

apparent lightness, these being externally treated as tapestry patterns stretched between vertical posts at the angles. It is evident that no entablature of any kind can crown such a wall, only a light ornamental head-band. Architraves of the windows may likewise merely consist of delicate and band-like borders without relief. It does not seem proper to decorate wall surfaces of a facade by tapestry patterns, when it has massive belts, cornices, and window architraves. Cornices and enclosing mouldings always require a background corresponding to their own character, and when of massive forms, the solidity of the wall must be visibly expressed.

144. Employment of Colonnades.

In forms of facades so far considered, the enclosing wall appears as a neutral surface, serving as a back ground for architraves and merely subdivided by belts and cornices. The base connects the wall with the ground; the entablature terminates it at top; but both forms are merely borders above and below the mass, which is itself inanimate. As the last step in treatment of facades are those, where the mass and weight of the wall masses appear overpowered by forms, which represent vertical aspiration and growth and compose an organically animated structure. Mediaeval architecture emphasizes only vertical aspiration and allows this to repeat itself upwards in forms, ever becoming more delicate. But Antique Architecture and the Renaissance create an ideal facade with a harmonious alteration of loads and of supports, of aspiring and of crowning dominant forms. The facade borrows the forms of temple architecture, where the colonnade exhibits this idea in the purest and most ideal form. (Fig. 199). The columnar construction is transferred to the wall surface in relief and is combined with other esthetic forms, which embody similar ideas. The representation of the structurally jointed and horizontally coursed mass of the wall dissapears; we see a facade in esthetic forms, which orginated in another material, have been conventionalized to suit stone, but represent a lighter construction treated on ideal architectural principles. A wealth of forms may be developed on the elevation in an organic way, which far excels that of earlier forms of facades. Since the entire structure posses an ornamental character, other decorative accessories may easily be combined with it, even if they no longer belong to the organism of the facade. Such types of facades easily keep within limits of great simplicity, and thus preserve severity and earnestness of actual structural forms. Yet it is natural for decorative columnar and pilaster architecture to assume a light and graceful character, then producing significant effect by its wealth of forms.

In the composition of the facade, the decorative architecture is usually placed above a high substructure with bold jointing. Yet this may consist

of a stepped base directly supporting a series of pilasters or columns. In applying columnar orders to ornamental architecture of facades, two principal types are distinguished. Several orders are placed above each other and correspond to stories (Fig. 200), or a single colossal order is employed with the division into stories treated in a subordinate manner.

Facades of the first kind occur with even four orders above each other; but as in the following examples, a facade is properly and organically treated with two orders only. Pilasters are preferable to engaged columns, since they unite better with the wall surfaces and require a less projection of the entablature above them. The greatest difficulty is to produce a united treatment of the facade, so as to not produce an impression of two structures placed on each other, but to appear as a single structure, commencing with the substructure and terminating with the crowning entablature. The entablature of the lower order is considered and treated as a belt course, that of the upper order being the crowning entablature of the facade. The former has a simple form and slight projection; for the latter it is necessary to develop the frieze with high consoles, which permits strong projection of the upper portion without making it oppressively heavy (Fig. 201). The consoles in the frieze support a strong slab on which rest modillions that support the cornice. To give the upper order a lighter appearance, it is made one-fifth to one-fourth less in height than the lower one

Pilasters or engaged columns are generally placed on pedestals; the lower order stands on a massive projecting substructure, and its pedestals have the usual subdivision and [illegible] tion But the bases and pedestals of the upper order may not project far, since the unity of the cade would then be broken by the width of these forms. Therefore these parts should have profiles of slight projection, being seen from beneath. A combination of plinth, scotia, and torus is suitable for bases of pilasters. The width of die of pedestal, and that of base of pilaster, should not exceed that of lower pilaster. Thus in spite of the slight projection of its base and its diminished height, the upper pilaster appears slender in comparison with the lower one.. To place a third order above the upper one and under the same conditions would not be possible, because it would be too weak a form, quite unsuited to recieve a crowning entablature adapted to the entire building.

The pilasters are usually so arranged that one pilaster is placed between two windows. The angle is strengthened by two pilasters. Windows of the principal story are larger and richer than those of the upper story. Their general forms are to be harmonized with spaces enclosed between pilasters. Different forms are employed; round-arched windows and angular pediments

produce a good effect in contrast with horizontal belts and cornices. When windows are set closer, it appears proper to decorate the upper story by pilasters and give it the effect of a gallery. The pediment-architraves of windows of the principal story form an effective contrast with such an upper story with simple forms of windows between the pilasters. For the angle, it is best to extend the lower rusticated masonry of the angle up beside the pilasters to the architrave as a pier, either plain or with flat bosses. By the projection of the upper pilasters, the upper wall surface must be set back from the lower wall surface.

145. Use of Engaged and Free Columns.

If the treatment of the facade must produce an effect of strong relief and an imposing impression, it may have engaged or free columns in two stories (Fig. 202); but we must then abandon a severe organism in the facade. Between the columns are to be placed the windows as arched openings with archivolts, their keystones supporting the entablature. To suit this purpose, these require greater projection and caps. The impost caps of window arches may rest on small columns doubled in depth and with plain piers beside them. The columns then act as structural members and all forms of the order must recieve their normal development. For free columns, it is necessary to break the entablature around them by at least half their upper diameter, since the keystone of the arch would otherwise require too great projection. Special difficulties arise in the treatment of the principal entablature, to crown the structure without burdening the upper order by its oppressiveness. This should terminate the facade in an unbroken horizontal line corresponding to the straight substructure. To fulfil these requirements, pier-like consoles are placed in a high frieze over each column and support a massive straight slab extending the entire length, on which the cornice rests. In order to avoid an unquiet outline at the angle, especially in case of free columns, the wall mass of the facade may project at the side as a wall pier; the various belt courses then extend to this and are carried across it as plain bands.

In accordance with the massiveness of the upper portions, such a facade requires a substructure with strong forms and bold masonry. It especially demands a strongly projecting base with large forms and a heavy cap with thick band, which has a continuous balustrade and forms an extended balcony in front of the principal story. Magnificent examples of this kind are found in later Venetian facades, especially of Pesaro and Rezzonico palaces by Longhena.

146. Use of a Single Colossal Order.

With a single order, a united and grand treatment of facade is possible with severe organic forms; yet this type of facade introduces conditions,

which can generally be fulfilled only in palaces (Fig. 203) and public buildings. To the dignified effect of the exterior must correspond the treatment of the interior. With such an order may be combined only a larger and a smaller story, so that it always produces the appearance of a great room extending through both, merely divided by a gallery. But if several stories with the usual window openings are to be combined with a single colossal order of engaged columns or pilasters, it would be easy to produce the effect of a previously existing colonnade, walled up later. The small details of window architraves are there in striking disproportion to the great details of the colossal order.

With grandeur of the facade must be contrasted strength and simplicity of substructure or ground story. Rusticated work is appropriate, either continuous, or only on piers beneath the pilasters or half columns, above this being a massive unbroken belt course. The substructure may also be opened as an arched portico when this is entirely finished in rusticated work. Pilasters or engaged columns may stand directly on the belt-course; they are generally placed on pedestals of the same height as the window sills. Pedestals recieve a flat band of the width of the window sill; this would appear too weak beneath the massive bases.

The main division of surface between the pilasters or engaged columns should not be made below the upper third of its height. A delicate belt course with a broad band beneath is appropriate for this. The lower surface is therefore generally suited to a harmonious treatment of the windows. The projection of the finish of the windows depends on whether pilasters or engaged columns are placed beside them. With pilasters projecting one-sixth to one-fifth their width, the window finish if composed of engaged columns supporting pediments, may project very strongly, and pilasters may project still more. But between engaged columns and in recessed niche-like spaces, only the pediment can have a good effect in dividing the surface, with a balcony or panel below the window, set in a line with the bases of columns or pilasters; a strong projection of window finish would fill ip the space too much and make it appear unquiet. Corinthian pilasters are best accompanied by narrow and plain wall strips beside them, which also extend along beneath the architrave in the same width, chiefly to detach base and capital from wall surface and to widen the slender and fluted pilaster to form a wall pier.

Since pilasters or engaged columns stand on a high substructure, the entablature in the ordinary form appears too small as a dominant member in contrast therewith, and it therefore requires a balustrade above, or an attic (Fig. 204) which may contain the windows of an upper story. Such a crowning member is always to be placed on a high base in order to make it visible above the prin-

cipal entablature. The angles of the facade are treated with piers, doubled pilasters, or pilasters with engaged columns. With a series of colossal pilasters or columns, two-story or one-story parts are easily combined. For in the central portion of the facade, round arched windows may occupy the height of the entire order; the impost moulding may be extended to the wings as the window sill of a subordinate upper story.

147. Balconies and Bay Windows.

Balconies and bay windows remain for mention as special parts of the facade. The balcony is usually placed before the first upper story, the belt course projecting above consoles, and it is enclosed by a balustrade. The corbels are organically connected with the wall if they spring from prismatic blocks connected with the masonry, especially in rusticated work. The balustrademay consist of perforated slabs imitating wooden lattice after the antique, or of balusters between the angle pedestals. In order to avoid a heavy appearance, these angle pedestals should be as narrow as possible; they may be strengthened on two sides by half balusters. The bay window is really an enclosed structure on a balcony. It should be light, and graceful, and constructed with architectural forms, having small columns or pilasters at the angles. Harmony with the architecture of the wall is only to be attempted in its heights. A bay window may extend through two stories if these are combined together in the treatment of the facade.

b. Horizontal Subdivision of the Facade.

148. Detached Buildings.

The centre of the building or vertical axis of symmetry is taken as a starting point for the horizontal subdivision of the structure. By a balanced arrangement of parts about the centre and by its symmetry, the structure appears as if entirely complete in itself. If the building consists of a uniform mass, it is first to be decided in accordance with the interior, whether this is to be arranged about a central vertical axis or a horizontal axis. For the first, we may commence at a central axis of symmetry in the treatment of all facades; for the last, this only occurs on an entrance or principal facade. A pediment and the portal mark the centre, while treatment of the sides expresses the sequence of internal apartments or divisions.

149. Facades between Adjoining Buildings.

Special consideration is required by facades built between other structures, as usual in city residences. An endeavor always prevails to emphasize the axis of symmetry by treatment of the portal. This accenting of the centre may be increased by placing a balcony over the portal. Another symmetrical arrangement consists in grouping the windows, employing similar forms. A larger group comprises three or five windows, and may be separated by spac-

es from side groups or single windows on each side. The central group may become a complete loggia. To mark a clear division in groups, decoration of the stories by pilasters or columns is especially appropriate. Single supports may either indicate this division, or these may be set in pairs to terminate the wings and to separate them from the middle portion, while spaces for the windows are subdivided. (Fig. 205).

It frequently suits the division into rooms to place the chief entrance at one side of the facade instead of at the centre. To then obtain an axis of symmetry, it is unnecessary to repeat at the other side the doorway as a useless form. It is far better to emphasize the centre by a group of windows and balcony or bay window, balancing the doorway by a larger window. But for a door with a simple architrave, this is not at all necessary. Instead of the centre only, both wings might be accented by balconies or bay windows. Lack of symmetry with a door at one side is then easily compensated, and this may even lend to the facade a certain grace.

150. Buildings with Rooms of Unusual Height.

If a building contains rooms of unusual height, then for an organic treatment of plan and facade, larger rooms may be placed at the centre and subordinate ones in the wings. If the height of apartments in central portion equals a two-story arrangement in the wings, a common entablature may then extend over the entire facade. A slight projection of the central portion is always best, to emphasize its importance. A series of colossal pilasters or columns is suitable for combining the two stories at the sides with the great windows of the central portion in a single organism. The upper arrangement may be repeated in the substructure, so that the great windows of the central part correspond to great openings for portals, and the wings in two stories to the superposition of ground and mezzanine stories.

To produce an effective outline it is best to treat the central part as a separate architectural mass, making this higher than the wings (Fig. 206). It then recieves a richer treatment than the latter and has larger forms. For the central portion, a columnar architecture with great arched windows, a free colonnade with pediment above, or compositions like triumphal arches are suitable. For contrast with the more open middle portion, the wings recieve broader surfaces and more simple arrangement of pilasters. A great exaedra or niche covered by half dome is sometimes a very effective form for the central part, or a portico covered by a tunnel vault. These forms require massive piers at each side, treated with pilasters or columns, the lower order supporting the impost moulding, the higher one supporting the entablature. Surfaces between them may have small niches with statues, etc. Such a central structure requires an attic above the main entablature, which may be a

pediment, or decorative sculpture (symmetrically arranged groups of figures, quadriga, etc.).

If such a building stands on a high substructure or basement, this should have uniform coursing and treatment to form a common base for the upper portion. At its centre will be a great portal, or an external staircase to the upper story. With a raised and projecting central portion, the wings should not be made too short, to not appear too insignificant in dimensions, or be entirely concealed by the central part if viewed obliquely. Hence slight projection of the central part is recommended, about one-sixth to one-fourth its width; the wings will be in good proportion if their lengths approximately equal this. With greater length of wings, it is proper to add to them special angle pavilions (towers, etc.); these usually have a vertical subdivision harmonizing with the wings, and the main entablatures are at the same height; compared with the central part, their lengths must be less than their heights.

151. Arrangement of Central Mass of Building.

The richest subdivision of an architectural structure occurs, when the parts of the building are grouped along its main axis and around a high central mass. This central mass is set back from principal facade, usually flanked on both sides by courts, and requires on its upper parts a treatment calculated for being viewed at a considerable distance. A dome first requires a high and undivided substructure, to become visible from below and over the surrounding masses of the building. Decorative architectural members, like columns, pilasters, cornices, etc., should there be of smaller dimensions, than on other parts of the building, and should have the greatest simplicity of details. Central masses of rectangular plan, cubical or prismatic in form, slightly subdivided and only crowned by an entablature or pediment, moderately predominant over the principal facade. As external surfaces of separate masses, side facades should likewise be symmetrically arranged; when quite distant from the central mass of the building, correspondence to it is not necessary.

152. Irregular Grouping of Design.

For buildings with irregular surroundings or in the open country, rigidly symmetrical arrangement may be omitted if the purpose of the building suits this. Yet a central mass must always predominate over the parts, and the building must balance in its masses. One wing may have a form like a tower, the other being treated as a horizontal addition. In country houses such grouping affords a free plan and harmony with the landscape. Monumental structures with irregular grouping may have a very pleasing effect, if surroundings and the form of site give oppurtunity therefor, as at the

Erechtheum in Athens.

Chapter 2. Internal Architecture.

153. General.

The essential purpose of all architectural creation is to produce rooms for the different requirements of human society (Art.92). The architectural treatment of the room is therefore placed on an equality with that of the exterior, if the building is to be a complete work of art. As in facades, so in the architectural treatment of rooms, we start from their construction. The form of ceiling is especially determinative, since by this fixes the subdivision of the wall. But the interior requires for its treatment some essentials differing from that of the exterior. External architecture must acquire a character of durability and stability. This is produced by a severely architectural elevation where the material used in the construction appears undisguised by the decorative form and requires uniform treatment. But in the interior, comfort, elegance, and richness, attract persons; works of the sister arts of Sculpture and Painting are suitably placed therein and combine with the architecture; the entire decoration produces a harmony, which corresponds to the intellectual meaning. Forms and materials required for the construction are unsuitable for this purpose. Strong and earnest forms on the exterior appear heavy and rude in the interior. The room requires a decorative covering, which permits the construction to appear in better materials, made attractive by artistic treatment and coloring, or an independent lighter ideal construction is executed. Thus different materials appear in the decoration in combination with each other, each requiring its own technical treatment and forms. Uniformity in forms, as on the exterior of a building of uniform materials, cannot usually appear in the interior. The room serves purposes more or less material, themselves requiring the arrangement of special furniture. The internal architecture must combine with this furniture, so that the latter may appear a necessary part of the whole.

Rising above purely material purposes, the possibility increases for giving the room a strictly architectural treatment, as in buildings for divine worship, museums, city halls, etc.

A difference is always made between architectural forms used on the exterior and in the interior of a building. On the exterior, relief of forms is increased by direct light, in the interior, light is usually insufficient for clearly seeing a form of a single color; polychromatic treatment must therefore aid us, especially in marking the outlines, and with a difference of color between background and ornament. On the exterior, forms must be designed for being seen from a greater distance and a direct view, therefore having a bolder and more massive character. But in the interior, they are

only viewed near at hand, chiefly obliquely from beneath; their profiling must therefore be more refined, details more delicate and intended to be seen from below.

The kind of ceiling permits forms of rooms to be divided into two classes, those with horizontal ceilings, andthose with vaults. In the first are considered various methods of covering the walls and of treating the ceiling; in the second, modes of subdividing rooms and the decorations suitable for different forms of vaults.

a. Rooms with Horizontal Ceilings.

154. Base and Cornice of Wall.

Horizontal ceilings exert only vertical pressure on the walls, which then only require thickness sufficient for this pressure and for their own stability. The treatment of the wall may then be uniform, or it may be replaced by a colonnade or arcade, or be pierced by doors and windows, so long as parts above these openings are able to support their loads. Every treatment for walls must first have at bottom a base connecting them with the floor, and a cornice at top. The base usually changes into the lower wall wainscoting of hard materials, a dado or paneling, which must be durable, as the lower part of the wall is exposed to injury. Stone and wood are suitable materials for this covering. Lining with stone slabs is especially appropriate with antique wall decorations. Stone slabs of rectangular form are then fixed above the base mouldings and are bordered at top by a flat band or belt-course. Wooden paneling also takes a special form at the base, and requires framework and rectangular panels. A moulded cap at top with a slightly projecting rounded profile forms a transition to the middle wall surface.

The surface of the wall require forms above it to both crown it and make a transition to the ceiling. The cornice belongs to the wall covering and has a frieze with ascending ornaments or figures. The cornice is the transition to the horizontal ceiling, and to express its function as a bearing form, it must appear as a course structurally united with the wall and corbelled out from it.

155. Wall Tapestries.

In the decoration of wall surfaces, their function ia enclosing the room should chiefly be expressed. Ornamental forms are therefore borrowed from the oldest form of enclosure, merely an inclosing by suspended tapestries. Since the wall is built of solid materials, a covering of tapestry formed the wall decoration during many periods of civilization. In the Graeco-Roman period, these tapestries with inwrought or painted figures played the chief part in the decoration of walls. During the entire Renaissance period, cost-

ly wall tapestries were preferred for churches and palaces on festal occasions. Perfected technical skill has now substituted cheaper manufacturing processes for earlier hand work, and has invented various substitutes for the costly wall tapestries, and these have been very extensively used in consequence of their cheapness.

In accordance with oriental traditions, wall tapestry has a uniformly repeated ornament or morive, but according to antique and Renaissance ideas, it should have within a wide border representations of figures or landscapes, or be designed on architectural principles. In the decoration of tapestry by the first method, it is important that this should be based on an easily recognizable geometrical form, like vertical stripes, squares, polygons, etc. Yet these forms must not be enclosed by geometrical lines, but be represented by ornamental shapes, which in their general effect produce the geometrical form. Such a surface pattern is appropriate when the wall forms a background for movable objects. The decoration of the wall must then be subordinate to objects before it; as a background, it must have a quiet and full tone and exhibit in different parts of the design no great diversity in color. A good effect may be obtained by patterns, where design and ground are kept in the same color tone, differing only in degree of depth. Tapestries with ornamental figures (Fig. 207) are used for enclosed spaces, and must therefore be suited for the wall surfaces to be decorated. The corners and centre of each border are emphasized by small panels with little figures, medallions, etc. Figures and landscapes are used in picturesque composition,

a purely ornamental expression must be arranged so that clear and appropriatedivision of surfaces and masses may result. The centre is always occupied by a large ornament, as by a graceful shrine with a figure, by a small statue, etc., whose enclosure combines with the other decoration. Shields, medallions, vases, etc., may also form centres of the ornamentation, which covers the surface with slender candelabra, arabesques, and festoons. The border should decidedly ride from the panel surface in its color tone. In Italian tapestries the ornament of border is usually dark on light ground, and conversely the decoration of the surface is light on dark ground; for French tapestries, the border is mostly dark with surface ornament on light ground.

156. Mural Painting.

Painting walls is directly connected with covering them by tapestries; older forms directly imitate the latter, and in its later development, the important laws of style borrowed from wall tapestries are strictly retained.

Each representation in tapestry has acquired a conventionalized form and combination of colors, so that the surface is never disguised, and this always

appears as a covering. Thus conventional wall painting strives less for realistic truth to nature in figures or landscapes, than to appear as a surface decoration by severe outlines and simple broad coloring with a perfected artistic effect. Early Grecian mural paintings in temples and public halls were imperfectly imitated in paintings on vases and by the latter we may learn the severely conventionalized and decorative character of the wall paintings. Even borders of pictures on vases are not suited to the form of vase, but indicate the mode of enclosing such wall paintings, and suggest that all mural painting then firmly retained the idea of tapestry covering.

157. M Pompeian Mural Painting.

A peculiar form of decorative painting was developed in later antique art. It is usually termed "Pompeian" as it chiefly became known in the cities of Campania buried by Vesuvius, of which Pompeii was the most important. In this mode of ornamental painting there was an endeavor to subdivide the wall surface and apparently enlarge it by making a slight architectural frame-work, suspended tapestries and perspective views forming the enclosure of the room. This is to be regarded as a pleasing fancy of the imagination, rather than as an actual deception, because not a realistic imitation of actually existing objects, but a sportive representation of light and graceful forms having a purely ideal existence.

Such a decoration (Fig. 208) is usually composed as follows. The lowest part is occupied by a dado of dark or black color, subdivided by lines and bands and containing in its panels, views, fishes swimming, birds, or plants. From this base rises a light architectural structure, enclosing the larger central space, by its prespective depth frequently appearing as a kind of shrine. This enclosure has a suspended tapestry as its motive, with a ricj border and a large picture with several figures. At the sides of the middle space are narrow views with architectural forms drawn in perspective. Side panels also represent suspended tapestries within light borders and are more simply decorated, having as ornament an ascending figure or medallion on tapestry ground. The supports of the architectural frame-work are slender columns, candelabra, or reeds, recieving a correspondingly slight entablature, frequently broken and is decorated by fanciful ornaments and additions. The entire architecture appears as if designed in metal and is usually of a golden color; deep red is preferred for the suspended tapestry, though other colors were likewise employed. Above the portion of the wall already described is a deep frieze, usually treated as if transparent. Upon the cap of the base stand shrines, candelabra, and slender hermes columns, which partly continue the lower subdivision of the wall, and are partly the upper termination of the wall surfaces, connected by light

festoons, bands and arabesques. The slight architecture of this transparent frieze is ornamented by dancing figures, winged genii, and fanciful beings of all kinds. Panels and open spaces are shown in perspective and do not at all harmonize, but relate to a near observer; the various parts are drawn with different points of sight. This wall decoration apparently enlarges small rooms by the gracefulness of its forms and by its views; but it requires the walls to be entirely unbroken, and with our custom of filling living rooms with furniture it is applicable in only few cases.

The Renaissance made no extensive use of mural painting as Roman antiquity as tapestries were preferred in decorating the finest apartments. When in the 15th and 16th centuries walls were ornamented by decorative painting, the modes of subdivision of walls and the ornamental forms of antique wall decorations were employed as far as possible. Favorite motives were the paintings in the Golden House of Nero beneath the Baths of Titus. Moderate use was made of perspective recesses in architecture, though they were correctly represented. Ornamental treatment of tapestries was also later very influential in mural painting. Architecture was replaced by a free structure with ornamental forms, animated by the most varied acessory figures.

158. Wooden Wainscoting.

Covering walls with wainscoting occurred in the earliest antiquity in Phoenicia. Bibical narratives of the building of Solomon's Temple and Palace are equally applicable to Phoenician architecture. Classic antiquity seldom used this mode of covering walls. Remains of dwellings scarcely permit us anywhere to assume wooden paneling, nor do ancient writers say anything on this point. But during the Middle Ages and north of the Alps, wainscoting was extensively used in houses, monasteries, and castles. In the 14th and 15th centuries joinery was separated from carpentry, and wainscoting changed from joining together narrow matched boards to a framework with inserted panels. In the Renaissance period, preference existed for wainscoting, especially in Upper Italy, shown by fine examples in sacristies, choirs, and apartments of palaces. Rich and finely developed forms of paneling were transmitted to Southern Germany and to France, assuming a national character in both places.

In constructing wainscoting, peculiarities of wood must be considered. It changes slightly in length, but its width continually varies in damp or dry air. This requires the construction of a framework of small width with inserted panels, which can move slightly within their spaces. The frame is frequently composed of doubled pieces, so that when wide, shrinking or swelling may be possible in its separate pieces.

The wainscoting of the wall is usually divided in two parts in height, a base with oblong horizontal panels, and the wainscoting proper with its high

panels. The lower portion is of simple form, but has a separate base as a wide band and a cap, which projects little and has a rounded profile. The upper portion may have ornamental pilasters or engaged columns between panels to support the cornice of the wall. (Fig. 209). In accordance with the smaller scale, the forms of the columnar orders are simplified and have sharp and angular shapes, so as to appear sufficiently prominent in the dark color of the wood. Among decorated mouldings, the large egg-and-dart moulding and delicate dentil bands have especially good effect; the leaf moulding is executed with simple incisions. Besides pilasters, the panels are decorated by enclosing bands, with a leaf moulding inside.

Inlaid work or intarsia in wood is a favorite method for decorating panels The use of veneers in different colors has the best effect in flat ornament for the intarsia. The Italian Renaissance understood how to fill each surface in great variety with ornaments of beautiful and pleasing form. Most ornament consists of conventionally treated plant forms, growing upwards from a vase or candelabrum, and extending in beautifully curved scrolls. The centre of the surface is marked by a plate, shield, or similar object, around which are grouped the principal masses of ornament, of interlaced motives, and small figures, in a regular way. This produces a clear composition with alternation of broad and delicate forms. In contrast to flat ornament of the panels, the framework may be decorated by bold sculptured ornaments. Leaf mouldings or egg-and-dart mouldings enclose them; the narrow surrounding frame has an interwoven band in low relief; pilasters are fluted, or their surfaces are sunken within a narrow border and decorated by carved ornament. The frieze of the entablature is also an appropriate place for relief ornament.

The German Renaissance recieved from Italy only the columnar orders of the High Renaissance Period. It employed these in its own way, partly combining them with existing native forms, partly extending them in the same spirit with new forms in bold relief. The ornament is ruder than that of Italian and is frequently composed of carved and perforated cartouches and metal-work. The lower third of pilasters and engaged columns is usually decorated by ornament like metal work, but the upper part is left smooth. The pilasters took a new form, borrowed from furniture, being diminished downwards with bold band-like ornament forms below its middle 9(Fig. 210). Such supports were also placed on elegant pedestals above the base of the wall. The pilaster recieves as background a wall-strip having the width of its extreme projections. The frieze of the entablature generally has consoles supporting the widely projecting and delicately profiled cornice. The panelling of the walls is treated in the most varied ways and boldly framed. Motives of the panels are

woods of handsome color, flat niches, arched panels with inlaid ornament, etc. Bold contrasts of color were sought in the paneling; structural portions are usually dark and consist of better woods, panels being light with a ground of beautiful grain.

Wooden paneling does not usually occupy the entire height of the wall, but leaves a deep unbroken frieze at top, decorated by painting or covered by painting tapestry. When the paneling covers the entire wall, paintings on wood panels or canvas are properly inserted in its upper portion instead of wooden panels. Partial gilding of the wood is necessary to set off deep and full colors of oil paintings, especially in the framework. Then intarsias also occur in the panels between the pictures and the base.

159. Marble Wainscoting.

Covering the wall with marble slabs succeeds wooden paneling for its better appearance. Even if a framework with panels is not formed, harmony of colors requires the larger slabs of varied coloring to be enclosed by bands of quiet tone and usually dark in color. The method of fixing this wall covering in place makes this arrangement suitable, large slabs being fixed by cramps sunk in their edges, the narrow bands being cemented in between them. Outer surface of slabs, of inlaid portions and of bands, are usually set in the same plane, because they may then be polished together. Only such bands project, which are to produce an architectural subdivision of the wall, and these recieve a corresponding profile. Since most kinds of marble have strongly broken tones of color, it is necessary to arrange them in complementary colors, to heighten this coloring. Slabs, when veined in various colors, are separated from enclosing parts by white lines, that the eye may distinctly separate the colors. Variegated marble, sculptured members, like capitals, bases, and cornices, when executed in white marble with some gilding produce splendid effect.

Marble wainscoting (Fig.211)found its richest development and most extended use in Alexdrian and Roman periods. Such decorations are imitated in Pompeian paintings (Temple of Jupiter, Basilica, Older Houses). According to Roman authors, luxury was carried to a high point under the earlier Caesars in covering walls. The covering of the lower part of the wall in the interior of the Pantheon remains from this era. In Early Christian and Byzantine periods, churches were veneered in the antique manner with marbles of different colors, mostly taken from ancient monuments; yet the broad surfaces of the antique wainscoting frequently give place to mosaics. The Renaissance invented imitation of genuine marble in stucco marble, which required much time and labor, but which is sometimes preferred for its uniform texture to real marble, where some veins are usually soft. The later Renaissance employ-

ed this stucco marble profusely, especially in Jesuit churches, and treated wall spaces with fanciful forms. Together with genuine marble, stucco marble is much used now, and properly so for decorating entrance halls, stairways and state apartments.

160. Treatment of Ceiling.

Treatment of the ceiling is generally independant of that of the walls, and in the best examples in the different art epochs the most diverse forms of ceilings occur with the different modes of treating walls. The ceiling may either have the construction visible and treated ornamentally, or it may be entirely concealed and covered by a decorative form, like an ideal structural framework or a stretched awning or netting, which transforms the ceiling into light, freely soaring and beautifully subdivided forms.

161. Structural Ceiling with Wooden Beams.

The simplest structural form of ceiling consists of uniformly spaced beams covered by a floor of boards. The antique ceiling of stone beams is merely a translation of a wooden beam ceiling into stone. Pompeian paintings prove that the wooden beam ceilings of antiquity have their structural elements left visible. This was the only method of covering rooms in the middle ages, and such ceilings were richly colored and gilded for state apartjents. In the earlier Renaissance period, this was ornamentally treated in the new form of the style; but from the 18th century, it was supplanted by the various forms of panels.

Decorative treatment of such a ceiling (Fig.212) consists in making prominent the functions of the different parts. The beams support the roof and their lower surfaces are ornamented by stretched bands or interlaced work, to make apparent the horizontal enclosing of the room. A cyma placed at the top of the walls is a symbol of the support of the ceiling above it. The latter may be subdivided in small panels by enclosing bands, each decorated by a symbol of suspension in form of a star, a rosette, or similar ornament. Beams are laid on the wall and either rest on a continuous cornice, or on consoles. The first is suitable when the wall is lined with stone, this cornice then being also of stone as a part of the wall, and treated like an architrave. For other treatment of walls, especially with tapestries or paintings on its upper part, it is sufficient if supports of beams are wooden corbels or consoles. It is proper in large rooms to rest the beams supporting the ceiling on heavy girders or main beams (Fig.213). If these are placed at moderate distances, have supporting cornices along their sides, and the ceiling surface between small beams resting on them are panelled by enclosing bands, this produces a dignified and highly ornamental form of ceiling, which may be decorated by painted and sculptured ornament, producing a very rich effect. It

here appears necessary to suggest the subdivision of the ceiling in the frieze of the wall and to place main beams on heavy consoles. As for painting the structural wooden beam ceiling, in the best ancient examples the colors of wood are seldom imitated, a combination of colors being generally executed with purely decorative views; the beams and the bands enclosing panels being light, the surface of the ceiling having a dark tone, from which the colored or gilded ornament clearly detaches itself.

162. Visible Roof Trusses.

In buildings containing large rooms, the frame of the roof may be left visible, forming both ceiling and roof. But the construction of the trusses must then be very simple and of monumental dignity, so that as strong triangles supporting the inclined ceiling, they may appear to the eye as sufficient. Decoration of these ceilings or roofs (Fig. 214) has the same requirements as horizontal beam ceilings. Purlins appear as large beams and rafters as light timbers supporting a covering of boards, that may be paneled by planting on bands. The structural parts should be painted light and ceiling surfaces dark. The use of visible framed roofs is not certain in classic antiquity. Yet it harmonizes with the structural spirit of Grecian architecture, as Schinkel and Klenze have shown by architectural designs. In the early middle ages, basilicas were generally covered in this way, which was sometimes so richly treated, that a splendid horizontal ceiling might have been constructed at the same cost. The framed roofs of San Miniato at Florence and of Cathedral at Monreale near Palermo are classical examples.

163. Ceiling with Coffers.

The coffered ceiling of wood with nearly square panels or coffers cannot be regarded as structural, but only as a decorative covering. Since beams are employed to enclose coffers in one direction, light boxes of boards are set in the other between the beams, to complete the paneling. But the entire system of coffers usually consists of light boxes of boards and is suspended, being ornamented by bands and rosettes. Yet coffering produces an impression of an ideal construction. The intersecting beams are represented by the soffits of the dividing members as a strong framework, above which the coffers are two or three recesses above each other (Fig. 215). The upper recesses are reductions of the lower form, and with their diminished size, the enclosing mouldings are also reduced. At the center of the coffer is a suspended ornament or a large conventionalized flower or rosette. For larger surfaces, scroll ornaments may spring from the rosette and spread over the ground of the coffer.

The coffer appears most richly treated, when dentils and consoles are substituted for simple enclosing angular recesses. Coffered ceilings of the great

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basilicas erected during the Renaissance period frequently have all the details of the Corinthian entablature represented in the beams enclosing the recesses. Five to seven coffers generally compose the width of the ceiling; a greater number appears monotonous. Transition to the wall is effected by a cornice, usually consisting of an angle with cymas above and beneath; the angle is frequently replaced by a row of dentils. The complete width of the soffit between the coffers likewise extends along beside this cornice.

The rich sculptured form of such a ceiling most clearly appears when but few colors are employed thereon. White and gold a re appropriate for enclosing parts, with blue or red for background of the rosettes and of the soffits. With deeper and stronger coloring of walls, the ceiling produces the most magnificent effect, when all the ornament and framework is in gold, the ground of the coffers and the soffits being blue. If the wall has a frieze below a ceiling with large coffers, the divisions of the ceiling should be short flat pilasters, decorated by figures in relief, çandelabra, or suspended wreaths of fruits (Fig. 216).

Instead of extending a uniform series of coffers over the entire ceiling, a larger panel may be arranged at its center, suitable for recieving an important picture; smaller panels enclose the central space (Fig. 217) with special shapes located at the centres of the sides and at the angles. The same principle always forms the basis of such a coffered ceiling; a series of strong beams are characterized as under stress and forms the structural framework. between which recessed surfaces appear as panels decorating by ornaments or figures. Too great fancifulness in the paneling is not permissible, because the construction is thereby made impossible.

164. Banded Ceilings.

Requirements are different for ceilings, where the surface of the covering above a series of beams is subdivided by slightly projecting strips. Such a division does not concern the construction, but appears as a light network stretched over the ceiling. To such decoration applies only the law (Fig. 218) that the centre should be made prominent by a larger panel with a rosette, figure or similar motive. While a ceiling with deep coffers is appropriate for high and large rooms, banded ceilings would be suitable for small rooms of less height, The natural colr of the wood then usually forms the ground tone of the decoration, which may consist of flat ornament with a partial painting and gilding of the wood. Transition to the wall is formed by a delicately profiled cornice. Such ceilings harmonize well with wainscoted walls. The wainscoting may then extend to the ceiling and connect with it by the cornice.

165. Painted Ceilings.

Forms of ceilings previously treated contrast with those consisting of decorations of stucco-work. The painting of the ceiling should cause the upper surface of the room to appear like a stretched canvass. Therefore this surface recieves a broad bordering band and an ornamental center, which represents free suspension and approximates to the ornamental forms of textile art. Bands that divide and enclose the surface may be painted as flat ornaments, or be raised in low relief. Painted ornament in the spaces may itself be slightly shaded, but must have cast shadows on the surfaces. Only separately enclosed pictures may be treated with picturesque freedom, since these represent on the principal parts of the surface special decorations (Fig. 219).

Such ceiling decorations are usually executed on a plastering of lime or plaster of Paris. It is easy to combine painting with low relief; the bordering forms of the dividing bands may have sharply raised forms, like cymas and beaded astragals, and be distinctly raised from the background by colored bands adjacent to it. The delicate gray shading produced on such relief mouldings by side lights makes a pleasing contrast to the full colors of the bands of ornament.

As for division of the surfacesof such ceilings, the center is always made prominent by a larger panel, surrounded by smaller panels at its sides and angles. Between them connecting bands of ornament subdivide the surfaces so far as necessary. The form of surface of ceiling naturally determines arrangement and shape of the panels, and a generally applicable rule can scarcely be given. The easiest arrangement is always the square (Fig. 220). Ornaments in intermediate spaces may be plant forms, candelabra, small figures, garlands, etc., and should always extend from the outer border inward, as if the ceiling rises at the center and the ornaments grow upwards; this arrangement is also conveniently viewed from below. Transition to the wall may be by a delicately profiled cornice; yet a larger cavetto is appropriate, since this form corresponds to the lightness of the stretched canvass and apparently excludes ll loading. Beneath such a form of ceiling, the wall frieze is most readily decorated by arabesques and by inserting large paintings in the architectural order beneath them. The Italian Renaissance treated such a frieze decoration richly and elegantly, for the free upper wall surface is the most visible place for pleasing representations of figures and for decorations.

186. Architraves of Doors.

Architraves of doors within the building should be lighter and of more elegant form, than those on its exterior. The pediment caps have smaller dimensions, since they are chiefly viewed obliquely from below. The Renaissance almost always constructed the door jambs and soffits of stone, and in the earlier period gave to them a wide decorated band (Doorways in Palace of

Urbino). Large doorways are finished with pilasters or columns supporting an entablature. A free decorative treatment of supporting forms is suitable here. Pilasters may change into Hermes figures and columns may be decorated by rings, rows of leaves, or incisions, in the most varied ways. A crowning ornament is also placed as a decoration over the pediment cap. An angular or curved pediment may either be broken at the center to recieve a bust or vase, or above the horizontal cornice of the cap may be placed special ornaments at ends and centre, connected by ornamented volutes or scrolls. Doors are usually of wood, only being of bronze in rare state doorways, and they are composed of framework and panels. The paneling depends upon the style and character of the adjacent architecture. Uniform square panels with rosettes on the panels and with disks or knobs on intersections of frame are appropriate for monumental doors; division into small and large panels of different forms decorated by ornaments or figures produces an elegant impression, and harmonizes with varied ornamentation of the room.

167. Large Rooms.

Large rooms require a clearly arranged architecture, which divides the wall and appears as a structural framework for its decorative covering. This purpose is most simply fulfilled by a series of pilasters forming two orders, if the room extends through two stories. The upper order is kept low and no frieze is assigned to its entablature. The arrangement of the pilasters produces a rythmical division of the intervals, adapted to any particular form of the apartment. Effective contrast in decoration of the intervals are obtained by covering the lower ones by ornamental forms or tapestries, the upper ones having figures. The ceiling must in its division accord with the arrangement of the pilasters; supporting beams must correspond to the separate supports.

168. Basilican Designs.

The special purpose and especially the necessary width may require the room to take the form of a basilica. This essentially consists of a high central space or aisle with colonnades or arcades along each side opening into lower rooms or side aisles, and lighted by windows in its sides above these. Side aisles may recieve light from the middle aisle, or external windows may be in the side walls. The light falls in the middle aisle from above and is very satisfactory for the general effect and for the decorations. Division into longitudinal aisles makes possible a great width with proportionally small spans to be covered, and with its varied heights and the arrangement of its columns, it produces a rich prespective effect. In decorating the interior, it is necessary to make the upper portion of the center aisle as light as possible, so as to not produce a heavy effect above the rows of

columns. The adjacent roofs of side aisles require a rather high wall above the spandrels of the arches, and this may be decorated inside by a deep sculptured frieze. The upper walls above this have light pilasters, supporting the high suspended ceiling with coffers; windows in the intervals have graceful architraves, surfaces are decorated by tapestry patterns. In contrast to this light decoration of the upper portion, the side aisles may be veneered with marble or stucco, so that the lower story appears as if entirely executed in stone. Ceilings of side aisles may have a massive character with large beams, serving to tie the walls together.

169. Rooms with Galleries.

These (Fig.221) usually have two colonnades or arcades above each other. Ratio of height of lower to upper odrer is then taken 3 : 2 or 4 : 3. Practical uses of such an apartment usually require wide spacing of the columns. The straight entablature is to be madeas if constructed of wood. Cap blocks with consoles at each side may be set over the capitals and produce a good effect, materially reducing free span of the architrave beam. Rooms with galleries may also have a basilican plan, if a third story with pilasters be provided; yet this produces a rather weak support for the upper walls. The following arrangement has a monumental effect: colossal columns directly support the walls of the clear story, its windows being placed between low pilasters and are wider than high: behind the columns and at less than two-thirds their height, galleries are supported by inserted pilasters or corbels. This combination of the gallery with colossal columns will not have a perfectly satisfactory effect, and the gallery will take the character of a wooden enclosure; yet this arrangement produces a dignified general effect in the room, and is stron construction.

170. Halls of Semicircular Plan.

With rooms having galleries belong semicircular assembly halls, which contain above a closed corridor a gallery open to the interior through colonnades or arcades. A large recess or niche is usually arranged in the straight wall for the tribune or platform. Such rooms afford surfaces very appropriate for beautiful decorative treatment. Above concentric rows of seats, a frieze with figures may be arranged on the continuous wall. The semicircular arch of the niche is suitable for a larger figure of especial importance. Beside the niche are surfaces for varied decoration and sculptured ornment. The ceiling may be painted to represent a stretched and richly ornamented canvass.

b. Rooms with Vaulted Ceilings.

171. General.

For the construction of plane ceilings and for covering them, the most

varied materials are used and require corresponding variety in decorative treatment. But in vaulted rooms, all surfaces of the ceiling are constructed of the same building materials. The ornamental treatment may then show a certain harmony in the conventional forms of the different parts. Tapestry coverings, wooden wainscoting, etc., always appear as extraneous additions in vaulted rooms; the proper structural and decorative material is stone and similar materials. But since these materials are treated in varied forms, are painted, or may be used as veneering, this varied treatment of similar materials produces an abundance of ornamental forms.

The general arrangement of the decoration is first fixed by the form of vault and by the construction of the wall. Vaults do not act merely as vertical loads, but are covering forms with thrusts, requiring abutments or buttresses. But the Antique and the Renaissance never left this construction externally exposed, but always connected it with the treatment of the room. This appears necessary and it makes the solution of the statical problem visible in the subdivision of the masses. The architectural and ornamental treatment then undertakes to clothe with an ideal construction the supporting masses and those covering the room, with which is always combined in monumental architecture the expression of great weight, this ideal construction indicating only contrast between support and load, and by its grace and lightness of forms causing the weight concealed behind it to be forgotten.

Vaults are decoratively considered as homogeneous stiff shells. Their decoration is then to be uniform, like that of a ceiling curved in different forms. Like the plane ceiling, it is composed of stiff arches or ribs, forming a structural framework, with spaces or panels lying between them, which may be considered as openings. The enclosing wall consists of supporting piers and of screen walls set between them, expressing aspiration and support, and the enclosure of space.

178. Tunnel Vaults.

The tunnel vault lays its load and its thrust on the side walls, while the end walls merely enclose the room The side walls require for the thrust a a much greater thickness, than would be necessary to support the thrust alone. They fulfil their purpose just as well if divided into isolated deep piers, which below the springing lines are again connected by arches. Spaces between the piers form extensions of the principal room like niches or chapels. The walls at the ends may be freely divided into piers or colonnades, or be filled with large doorways and windows. Tunnel vaults are either built of uniform thickness, as in brickwork, or composed of separate supporting transverse arches of cut stone with slabs or light masonry placed between them. In the first, side walls may be divided into piers and niches at pleasure, but in the last,

supporting piers must be set under the arches of the vault (Fig. 222).

The forms of construction described suggest the mode of decorating surfaces of vaults. The tunnel vault has a uniform decoration over its entire surface, appearing in many variations, from painted network or foliage-like decoration to a series of deep coffers. Elegant painted vaults are found in the baths at Pompeii (repeatedly interwoven bands enclose panels of different dimensions, in which soar small figures), in Roman tombs (usually combined with fine stucco work), and Renaissance villas (Villa of Pope Julius, arched corridor with delicate lattices and scrolls of foliage). Coffers (Fig. 223) are treated on the same primary principle as plane ceilings, and may have square or polygonal coffers alternating with small square ones. In Roman architecture, only arches and horizontal beams were of brickwork, wooden forms being set on the centering to form the coffers, this portion of the vault being of concrete. (Temple of Venus and Roma; Basilica of Constantine; Rome). A row of coffers is always found at the crown of the vault, usually with a larger panel at the center (The ornamental arrangement of such panels in vaults of triumphal arches permits the assumption of ceiling lights in vaults of temples). The number of coffers in the width is 7 to 15, according to dimensions of the vault.

A strongly projecting cornice separates the wall and vault. Its forms are derived from those of the Ionic or Corinthian entablature. Its projection conceals from below a large part of the surface above it. This indicates that decoration of the vault must commence above a plain band of the same depth as the cornice, and that the vault should be stilted accordingly. Subdivision of walls below the springing may be according to different systems:- 1. In solid walls, separate niches may be arranged with pediments and columns, a continuous frieze extending above them. 2. If the wall be interrupted by large niches covered by tunnel vaults or halfl domes, free columns may be set before the piers, their entablature at the same time forming the cornice for the vaults over the niches. Above the columns are suitable places for statues. Lighting is best effected by large semicircular windows in walls at ends of vaults.

Different antique structures exhibit a structural and decorative development of tunnel vault in cut stone, that recalls stone beam ceilings of temples. Stron supporting ttansverse arches have sections like beams bent into a semicircle; on these are set closely large moulded stone slabs. Such a construction produces a monumental impression in accordance with the material, yet the arches project strongly, and when viewed obliquely, conceal a large part of the slabs and appear monotonous by reptition. The Renaissance treated tunnel vaults generally in accordance with these principles, but proceeded in a

purely decorative way (Figs. 224, 225). Transverse arches are flat, are decorated by bands on their lower surfaces and by cymas on their sides; the slabs have large panels low mouldings, and consist of framework and panels according to the structural princi.le. The entire ornamentation represents ideally a light curved flat ceiling, or perhaps a bronze decoration of the vault. This decoration of vaults is intimately connected with the architecture of the longitudinal walls, subdivided into separate parts. Pilasters are set under the arches and are even in pairs, to support a wide paneled arch. The light character of the intermediate vaulting introduces intersecting vaults with windows over the arched openings or chapels along the sides. Such architecture affords good lighting for the rooms and produces great freedom and variety in decorative treatment. Large vaulted Renaissance churches afford exeellent examples. The strong buttresses of tunnel vaults permit the formation of side rooms or chapels, again covered by tunnel vaults at right angles to the principal one, by groined, or by welsh-groined vaults.

In small rooms lighted at their ends, tunnel vaults may be set on colonnades or arcades, the thrust being transmitted through the ceiling of the side passage to the outer wall. With light and graceful decoration of the vaults, such rooms produce a rich and elegant impression (Fig. 226). We might give to tunnel vaults over large flat rooms a flat elliptical form. A varied panelling with flat enclosing borders should be most suitable as decoration, to produce an impression of great lightness in ornamental treatment, like the construction. Such an example is supplied in the magnificent ceiling of the Library of St. Mark in Venice, Fig. 227, decorated by paintings by Paul Veronese.

The inclined tunnel vault is used over stairways. Decorative transverse arches are not placed at right angles to the axis, but must always be set vertically. Since oblique intersections with longitudinal bands result, scrolls of leaves and fruits are most appropriate for ornamenting the entire visible framework, giving the vault a very light effect, making imperfections in subdivision not prominent. A magnificent example is found in the Scala d'oro in the Doge's Palace at Venice (Figs. 228, 229). The festoons are white on gold groundand the enclosing cymas, etc., are partly white with gold framework. Large spaces on each side contain colored figures, those in the middle have white reliefs on gold ground; long bands have colored ornaments on light ground, and small squares arr filled with reliefs on gold ground. On account of the ratio of length to the small width of the stairway, the irregular treatment of the wall surfaces is not easily perceived, since one views the whole as foreshortened.

173. Groin Vaults.

While the entire length of the tunnel vault rests on abutments, the groined vault is the intersection of two tunnel vaults, only resting at four points on supporting piers. Its pressure first loads the four groins or ribs extending diagonally between the abutments, and it is transmitted by these groin arches to the piers. The decoration is closely connected with these f groins, which are considered as principal lines; the vaulted compartments are regarded as uniform surfaces between the groins. The groins or ribs are first ornamented by foliage scrolls or similar forms in relief, along their sides extending cymas or beaded astragals as a transition to the surfaces of the vault. In the middle of the vault may be placed a rosette (Fig. 230), or a figure in a circular or polygonal frame. Decoration of intermediate surfaces produces simple forms, if at the centre of each triangle be placed a circular or pentagonal panel containing a figure. The direction of the object is from the outside towards the center; the angles are filled by ornament extending from the springings. In contrast to the decoration of the arches, the entire ornamentation of these surfaces may be either by painting or be in l ow relief, appearing as light tapestries or ornamental network stretched between foliage scrolls.

In a series of groin vaults the bays are usually separated by flat panelled transverse arches. Yet the compartments of the vault may be joined and decorated together. Large square panels may then be surrounded by smaller polygons and produce a good effect, for they appear in continuous straight lines as viewed lengthwise the vault.

Abutments must be massive piers, capable of resisting both vertical pressure and the thrust. Inside them, projecting pilasters with entablatures recieve transverse arches and ribs of the vault, permitting the observer to forget the thrust that acts sidewise. If free columns with an entablature are set beneath the springing of the vault and before the pilasters, merely appearing to support the vault, then according to the light s decoration of the vault, the supporting forms will have a character of light aspiration and support, the vault with its graceful forms appearing to lightly rest on the columns. This treatment was especially peculiar to large antique columns with groined vaults (Fig. 231). Spaces between the piers are joined to the principal room and large semicircular windows may be placed in the wall above them and beneath the arch, through which room is lighted in the most satisfactory way. These spaces are frequently separated from the central room by small colonnades.

The groin vault is especially suitable for arcadrs open along one side. In Roman Renaissance architecture, piers recieved on their external sides engaged columns with an entablature above them. Thus the heavy form of the pier was subdivided, and recieved a character of aspiration and support; the engag-

ed columns further to serve to strengthen the abutments, for the piers require considerable depth to resist the thrust, with but moderate width. The greatest lightness of construction results, if in vaulted porticoes groined vaults rest on columns instead of piers; yet the imposts must be tied by iron rods.

174. Pendentive Vaults.

Pendentive vaults are closely allied to groin vaults by their uses, and consist of a spherical surface described with half diagonal of square to be vaulted as radius. Semicircles on the four sides limit the surface of the vault; a horizontal circle at the crowns of these arches divides it into a central plain calotte and four pendentives. These surfaces are much better suited to a uniform system of decoration, than are those of the groin vault of four compartments, and the former is therefore preferred to the latter in modern architecture. In statical condition, the pendentive vault is similar to the groin vault, but the side arches recieve part of the thrust, and should therefore not be too narrow in open vaulted porticoes. These arches have plain panels in their soffits, and their slightly projecting sides are bordered by cymas. The calotte is only separated from the pendentives (Fig. 232) by a belt of slight projection, since at this band the surface of the vault is inclined at 45 degrees. Suitable modes of decorating the calotte by coffers, by division into four large panels with figures, between them being narrow bands with a decorated circular space at the crown (Fig. 233), or by representing a tent roof with its decorations. Pendentives contain soaring figures, garlands, medallions, or onnaments rising from the imposts. All belts and enclosures are light in their general tone, decorative panels being colored.

If the Romans preferred the groin vault for covering large rooms, it may be because it was better adopted to construction in concrete with separate cross arches, than would be a vault with spherical surfaces. For vaults entirely of brickwork, the pendentive vault presents less difficulty and has greater strength at crown than the groined vault, which is very flat there. Subdivision of rectangular rooms into separate squares and covering these by pendentive vaults produces a plan of room similar to that of Roman halls with groin vaults (Figs. 234, 234a, 234b) Vaults may likewise be apparently supported by columns set before the piers, whose entablature forms the pier cap. Lighting may be either by large windows at sides and in walls beneath the arches, or by skylights in vaults. Spaces or chapels between the piers are covered by tunnel vaults, and are suited to recieve galleries above small colonnades, which materially heighten the effect of the colossal columns supporting the vaults and of their massive entablature. This produces great variety and effective gradation of architectural forms and of enclosing surfaces, very ap-

propriate for decorative treatment. Yet with all its richness, a clear arch-structural subdivision predominates, and this mode of treating an interior produces an imposing and rich, and harmonious impression.

175. Domes.

The perimeter of the dome rests on a vertical cylindrical wall, exerting on this a uniform pressure and thrust; this cylindrical wall requires a treatment like that of walls supporting a tunnel vault. The wall may be penetrated by openings, or it may be concentrated in supporting piers connected by arches below the springing. The deep niches or chapels of the Pantheon in Rome (Fig.235), apparently divide the wall into eight great piers, which externally contain hollow semicircular spaces. The vertical cylindrical wall is separated from the dome by a bold entablature, which should nearly correspond to that of a colonnade of equal height. As decorations for the dome, coffers of approximately square shape are appropriate, since the vertical and horizontal ribs clearly emphasize the form of the hemisphere. In the best examples, the number of coffers in one row is 24 to 28, with 5 or 6 in height. Above the coffers, a deep ring surrounds the sky-light, bordered by a delicate moulding next the latter. The opening for light has a delicate cornice at top, and its vertical surface is treated as a frieze-like band. Its lower edge may have a round moulding ornamented by leaves.

The division into coffers is independent of subdivision of wall beneath. But the vault may instead be decorated by large panels alternating with narrowbands or small coffers. Eight broad spaces are usually separated by intervening narrow panels or bands, being enclosed by these above and below, and small square coffers are then placed at the angles. As in the treatment of the tunnel vault, the relief is kept low and the bands or ribs project only so far that cymas may be formed beside them. The large panels may then be enclosed by delicate mouldings, receiving figures in low relief or paintings. This treatment appears especially appropriate, when the dome covers a plygon and not a circle. Such antique interiors show effective treatment of the wall; a gallery is arranged in the wall above the great lower niches and opens into the room by an arch above each niche, supported by small columns. The circular closed form of wall, the vaulting recalling the sky, the light from above, illuminating all objects in an unusual and very effective manner, all impart to a domed interior a solemn and earnest effect, making it especially suited for sculptures in relief.

176. Groin Vaults enclosing Panels.

All forms of vaults heretofore considered are based on the semicircle. But in residences and palaces, heights of larger apartments are seldom sufficient to be covered by previous forms of vaults. These are rather used on a large

scale in monumental public buildings, churches, museums, libraries, etc. Where used in residences, this is on a small scale in vestibules, loggias, corridors, etc. But to give ceilings in palaces a monumental decoration and make them suitable to recieve costly ornamentation and paintings, the Renaissance invented vaults, which required less rise for large spaces, thereby approximating to plane ceilings. These consist of various forms of groin or coved vault with horizontal central panel (Figs. 236, 237). This form of vault rises steeply from the wall and towards the centre passes into a larger slightly curved or plane surface. Such vaults are seldom built with reference to the forces acting in them and their durability chiefly depends on good mortar. A true vault of this kind over a rectangular room has the central surface supported by half tunnel vaults (cove ceiling, Fig. 238). Reducing the central surface, this form passes into the cloister vault. The best proportions for decorative treatment result, when the central space with its enclosing cornices has about half the dimensions of the rectangle enclosed by springing lines. The half tunnel vault is then suitable to recieve large pictures, extending from lower to upper border, conveniently placed for the eye. These painted surfaces may be limited at angles by extending the bands enclosing the central space. These triangles may be filled with arabesques, perhaps with a middle panel. The central space is enclosed by a delicate cornice of slight projection with a broad band. To not require masses of stucco-work, the section of this band should be kept close to surface of the vault. The subject of this central panel should contrast with the lower figures, and be decorative in its nature, consisting of rosettes, arabesques, garlands, shields of arms, etc. Beautiful examples of such Renaissance decorations are found in the middle loggia corridor in the Vatican containing Raphael's Biblical pictures, (where this vault is used above semicircular arches to cover the separate bays of a long corridor), as well as in the salons in Massimi Palace and in Villa Lanti at Rome.

The most extended use during the Renaissance was made of that form of this vault with the cove intersected by a series of compartments, thus forming a half groined vault (Figs. 239, 240). The middle surface consists of panels of two kinds, alternating in shape and location and very suitable for decoration; windows extend to crowns of side compartments and thus completely light the room. Instead of a complete vault, the central space is frequently enclosed by a wooden frame, against which t abut the marginal vaults, and it is then treated as a coffered ceiling or is filled by a large picture, composed to suit its location. On the edges of the outer compartments and on the ribs of the groined vaults are leaf mouldings or rounds, carried horizontally around the border of the middle space. Within this is an enclosing member,

which projects little in a complete vault, but with inserted frame and raised panel may have the complete profile of an entablature. In the decoration, the different surfaces have a varied treatment in color and ornament. If ends of side compartments are closed, these surfaces and the central space are suitable for picturesque compositions. In contrast with these, the compartments and the triangles or pendentives receive a predominating ornamental decoration with ground tones of different colors. Many Renaissance decorations have in the pendentives shrines with figures, supported and accompanied by ornamental forms (Fig. 241). These surfaces may also be divided into a hexagon and three small triangles, the first being appropriate to recieve a figure. Such a decoration was employed in the portico of Villa Farnesina in Rome by Raphael. Painted garlands of leaves and flowers cover angles of the compartments and enclose the central surface. Panels have blue grounds and are treated like the sky, on them being represented the story of Psyche with figures soaring as if resting on clouds. The whole exhibits Raphael's sense of beauty and produces an enchanting effect, which could only be produced in similar decorations by a master with genius.

c. Connection of Apartments.

177. Rooms arranged in Suites.

Simple forms of rooms may in many ways be combined to form suites of apartments. They may be either directly joined, appearing as portions of an apartment, or be merely arranged in a series along main axes and connected by doorways, forming the separate divisions of a building. Thorough treatment of connection of rooms is not intended, but it will be briefly illustrated by some examples. The arrangement of rooms as first mentioned first appeared in many Renaissance basilicas, where with horizontal ceiling of central aisle, side aisles were covered by groined vaults or pendentive domes. The heavy loading of arcades by clearstory walls so nearly neutralizes the thrusts of the vaults, that their resultant is but slightly inclined. The necessary buttresses are included witnin the building to form recesses for chapels. The side aisles thereby has a rich and architecturally beautiful treatment, with an effective contrast to the spacious middle aisle. As in Early Christian models, the choir usually ends in semicircular form and is covered by a half dome. Beautiful examples are found in basilicas by Brunelleschi in Florence (with rectangular apse) and San Bartolomeo in Bologna (with ceiling lights in pendentive domes of side aisles).

It was most common to combine various forms of vaults in subdivided plans of rooms, using horizontal ceilings and vaults over different parts. A combination of groin and tunnel vaults was mentioned in the description of Roman halls. Pendentive or depressed domes form harmonious combinations with all

semicircular type of vaults. With a skylight and covering the central part of the room, supported by four strong piers, they produce with adjacent vaults a strongly united form of room. Thus the Bracchio Nuoyo of Vatican Museum with two tunnel vaults and half dome, the whole being lighted by skylights. In vestibule of Villa Madama, Figs. 242, 243, the central pendentive dome is flanked by two groin vaults and extended in depth by a tunnel vault; each room with groin vault is extended on two sides by large niches.

178. Connection of Room with Central Building.

If the central space be increased in height by placing a dome over it, and if on four sides lower tunnel vaults or half domes adjoin it, this produces the grand and beautiful combination especially developed in Renaissance churches and known as a centralized building. The central space consists of two forms placed one above the other; the lower part is square, with four piers connected by semicircular angles arches and supporting pendentives, which form at top a horizontal circle and are crowned by a bold terminal cornice. Surfaces of these vaults are portions of a spherical surface, when piersstand at angles of a square. But if the piers are partially moved into the square and its angles are cut off by straight lines, the pendentive vaults form peculiarly curved surfaces, which horizontally gradually pass from right lines into a circle. These surfaces overhang the less, the more nearly the plan of the room approximates an octagon. This is much better suited to support a heavy and large superstructure, than are regular pendentives over a square. Above the circular cornice of the pendentives rises a vertical drum and a dome resting on it. The drum must recieve the thrust of the dome and therefore usually has projections on its exterior to make the interior of the dome appear light, and to admit light freely. If the pendentives are placed over a square, this dome cannot exert a great vertical pressure on them, and should have but a moderate height. Both the form of vault and the scale of execution are decisive, for construction may be executed securely in small dimensions, but the resistance of the materials does not increase with its
dimensions, but the resistance of the materials does not increase with its
dimensions. It may generally be taken as a rule, that the higher the drum and dome are made, the more closely the plan of the pendentives should approximate to an octagon, when its heights are similar (Fig. 244). This produces proportions harmonizing with the construction and pleasing to the eye; dimin-
proportions harmonizing with the construction and pleasing to the eye: dimin-
ishing the main sides of the lower part, arched openings become more slender and a corresponding form then results structurally in the superstructure. But with the square, arched openings are usually wide and require structurally and esthetically only a slight increase in height of the dome.

The following principles are applicable to architectural forms of the prin-

cipal space. Pilasters or columns are set in front of the four main piers and their entablature forms the impost cornices for main arches. This causes the construction to lose the impression of heavy massiveness, and it acquires a character of aspiration and support. The surface of each pier next the central space should have a niches with tablet or relief above it. In each pendentive surface a large circular space should be enclosed by a bold moulding, filled by a figure, the remaining angles recieve ornamental decoration. The upper limiting edge of this vault has a bold half round, above which is a vertical frieze, and the pendentives then end with a strongly projecting cornice of larger dimensions than the impost cornice. The vertical frieze prepares for the vertical surfaces above, so that by contrast of the strong cornice with the refined forms of the dome, its dimensions are apparently increased, and the base of the drum, whose simple form rests rather heavily upon the pendentives, is concealed from below. Above the plain base the drum has a series of pilasters whose height is two-thirds to one-half that of lower order. The intervals are arranged on the lower axes, contain windows with simple architraves, and are from eight to sixteen in number, according to height of dome and size of building. The dome is always subdivided to suit the arrangement of the pilasters, so that large spaces are above windows. In contrast to the lower architecture, the drum and dome should have a character of gracefulness lightness, assisted by colored decoration, the lower part having relief ornament to suit its bolder architecture. But pendentives are usually decorated by painting.

Rooms adjoining the central space have tunnel vaults and compose a cross form, in whose angles are usually placed smaller domed spaces connected with the side rooms by large arches(Connection with central space would weaken the piers or diminsih width of arches across arms of cross). Deco ive treatment of arms of cross follows that of central space. The order of pilasters extends in them and the tunnel vaults have coffers. The severe and heavy effect of coffers by contrast makes the decoration of dome appear lighter and more elegant. Instead of cross arms with tunnel vaults, semicircular apses covered by half domes and with gallery passages may adjoin the central space. The great pilasters in the central space must be omitted, or they must be made so slender and purely ornamental, that connection of architecture of central space with that of adjacent half domes is made possible. The centralized building, though having an ecclestiastical origin, is frequently used in secular architecture, if treated in accordance with a noble and ideal solution of the programme. "The whole should be essentially a building of purely esthetic aspiration for the architectural forms in themselves, just as well suited for every other ideal purpose as for divine service".

179. Heightening the Effect.

The different rooms in an architectural design may, as stated in Divisions 1 and 3, be divided into vestibules, communications, and principal apartments, according to their purposes. According to the importance of the rooms, a suitable gradation should appear in their decoration. In the order in which we pass through them to the principal apartment, there should be a transition from severe architecture of the exterior to elegant colored ornamentation. Therefore the vestibule and the entrance hall retain the character of the external architecture, and we economise decorative forms there, to heighten the effect in succeeding rooms by greater richness. Vestibules should be less strongly lighted than the principal apartment, to produce a gradual increase in lighting. The effect of rooms uniformly lighted by light from high above is materially increased if we enter through a darker vestibule. The highest effect in decoration and the most harmonious lighting is required in the chief apartments of the building. These should express in monumental designs the intellectual significance of the building, where the form of room, its decoration sculpture, and painting work together in a harmonious way.

DIVISION V.

VESTIBULES? STAIRWAYS, COURTS, AND HALLS.

By Professor Heinrich Wagner.

180. General.

Since the general designing of a building in plan, and section has been considered in the last Division, this last Division of Architectural Composition may then dismiss the arrangement of the building further, so far as it concerns rooms for common use, more or less developed in nearly every building, such as vestibules, stairways and courts. Designs for halls so commonly occur as entirely independent, or as portions of other buildings, that they are here subjected to general study.

The importance of stairways, vestibules, and courts, and their location and arrangement were discussed in Division 3 (Arts. 114, 128); their architectural treatment, with that of halls, was treated in the last Division. We now have to investigate their plans in general, their relations to each other, and to the principal parts of the building. From the intimate relation of these portions of the building, especially of the vestibules, stairways and courts, they cannot be separated, but are rather to be considered as a whole.

Chapter 1. Vestibules and Doorways, Entrance Halls and Corridors.

181. Diversity in Plan.

According to whether a building is to serve for public or private purposes, the plan of its ante rooms, vestibules, entrances, doorways, entrance